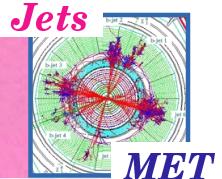




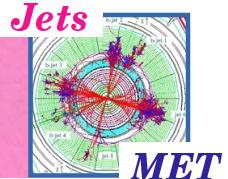
ECAL THRESHOLDS AND JET/DI-JET RESOLUTION



Salavat Abdullin, UMD



- What we are worrying about ?
- Data samples
- Calculational details
- $Z'(120)$ results
- QCD di-jet results



PREOCCUPATION

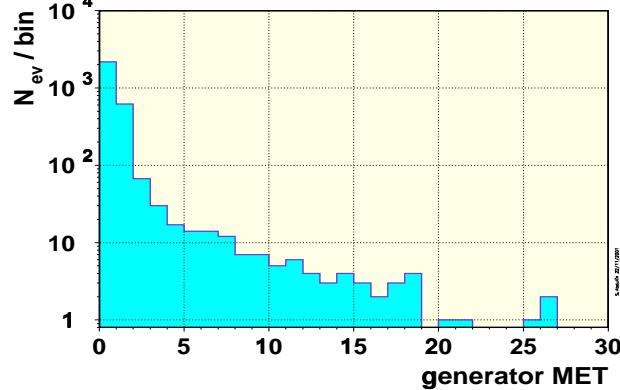
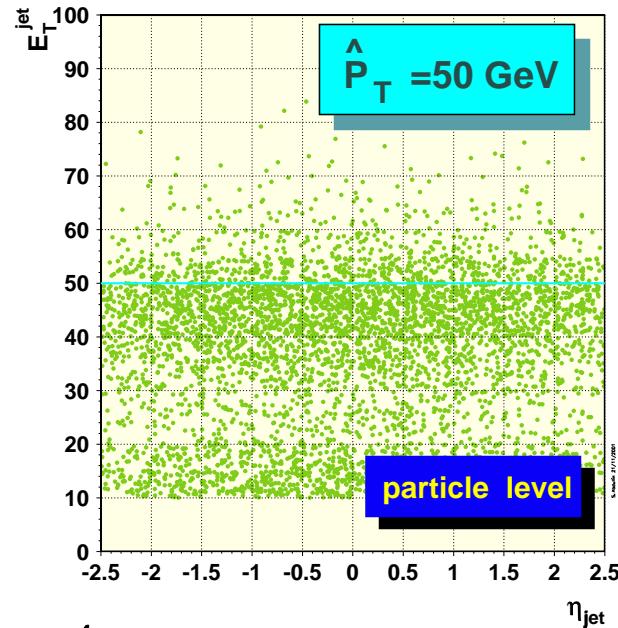
- ECAL selective readout assumes a significant reduction (factor ~ 20) of full data (10 frames) samples stored for the subsequent off-line analysis
 - Zero suppression above some cut (2.5σ ?) out of "interesting" regions
 - All (or almost) preserved in specified (ECAL L1) "interesting" regions
- What about jet (di-jet) energy resolution and missing E_T measurement precision ?
- ECAL community : it's OK, not a main limiting factor ...
- HCAL community : probably so ...



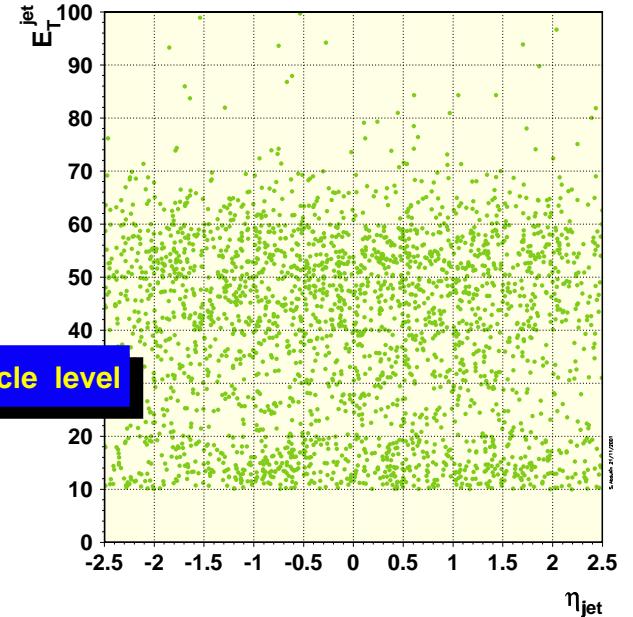
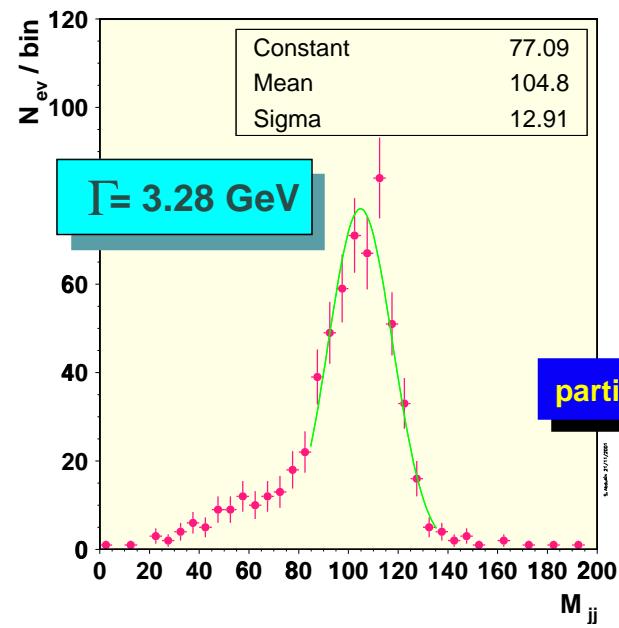
SAMPLES



QCD di-jets



Z' (120) → jj (uū, d̄d̄)

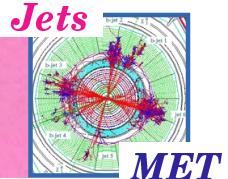


qq̄ → Z' → jj (uū, d̄d̄)

ISR / FSR
multiple interaction } on

Particle-level preselection : CMSJET
min. 2 jets with $E_T > 30 \text{ GeV}$ within $|\eta| < 2.5$





CALCULATIONAL DETAILS : CaloRecHit CUTS

■ Readout thresholds (CaloRecHits)

Set No	HCAL threshold (MeV)	ECAL threshold (MeV) barrel / forward	
1	- ∞	- ∞	- ∞
2	0	0	0
3	500	- ∞	- ∞
4	500	0	0
5	500	30*	150*
6	500	60**	300**

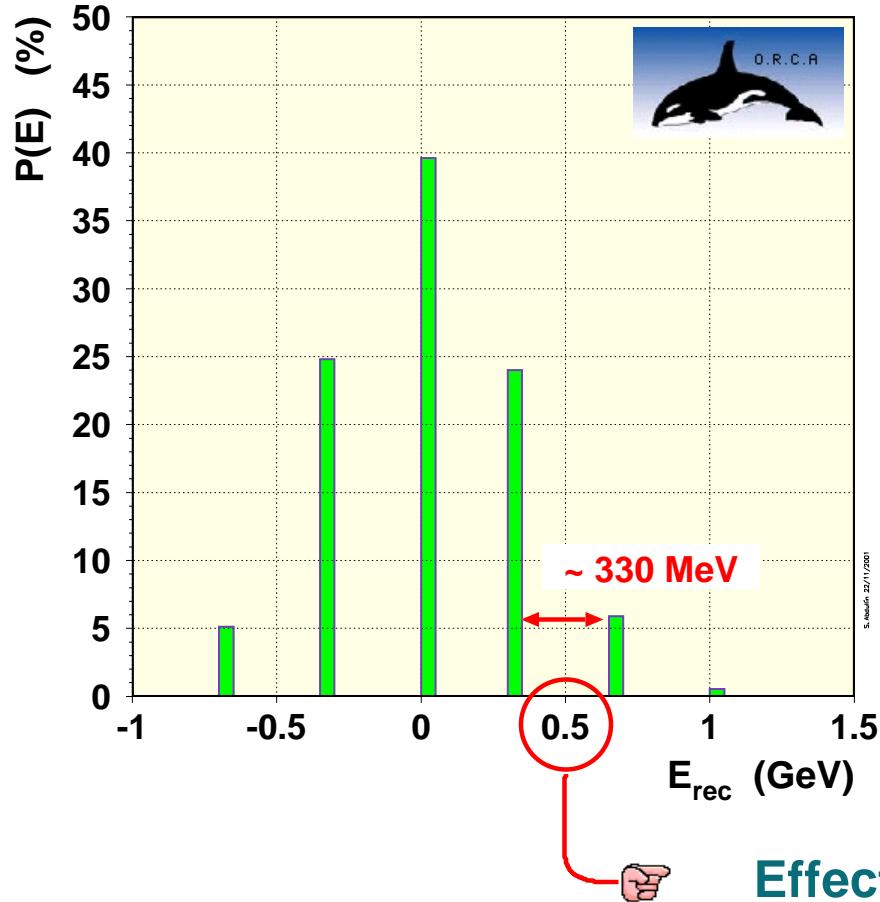
* $\sim 1\sigma_{\text{noise}}$ ** $\sim 2\sigma_{\text{noise}}$

■ All RecHits stored

- no thresholds
- thresholds set in EcalPlusHcalTower formatter

■ Objy DB size > 15 Gb

- 3000 QCD dijets
- 1000 Z'

 Single readout noise New HCAL prototype code

- 1 depth layer (HB/HE) + HO
- Layers 0 & 1 "re-weighted"
- Signal integration in 2 bkits
- ADC quantization
- Photo statistics effect
- Hit time jitter
- HF splitted from HB/HE
- etc.

 Effectively means ≥ 2 ACD counts ...



CALCULATIONAL DETAILS : JETFINDING



■ IterativeConeAlgorithm

- $R = 0.5$
- Seed = 3 GeV
- $E_T^{\min} = 10 \text{ GeV}$

🚫 Does not work (infinite loops) with negative constituents

- 🐞 general bug fixed (exit on finite number of iterations corrected)
protection against divergency introduced



■ Jet energy corrections = $f(E_T, \eta)$

- 12 sets of jet corrections for each ECAL+HCAL set of cuts
6 for QCD + 6 for Z'
- quadratic fit in 12 η bins (0-2.4)
- a bit special : fairly low jet energies
- $R = 0.2$ match, $E_T^{\text{genjet}} > 30 \text{ GeV}$

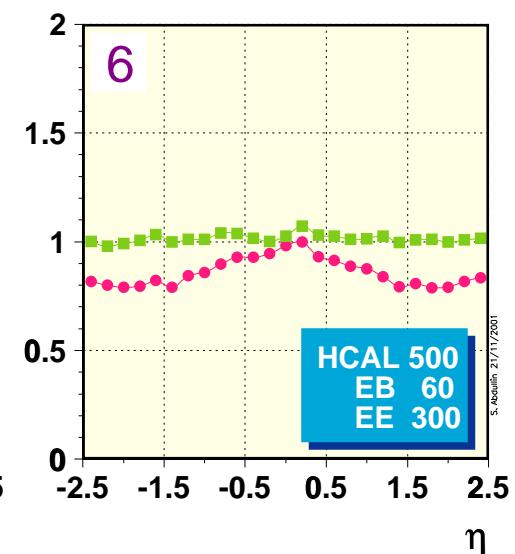
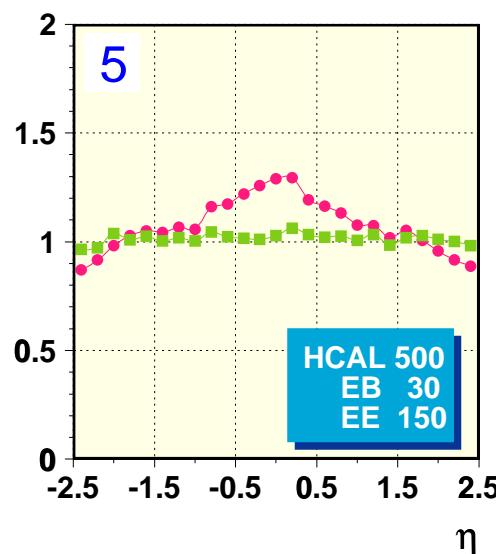
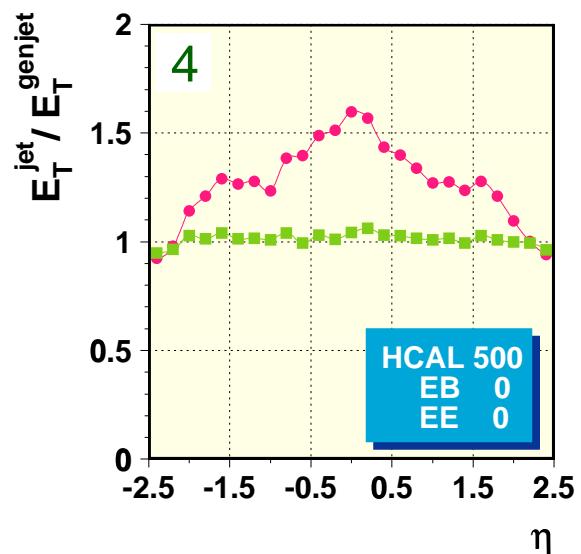
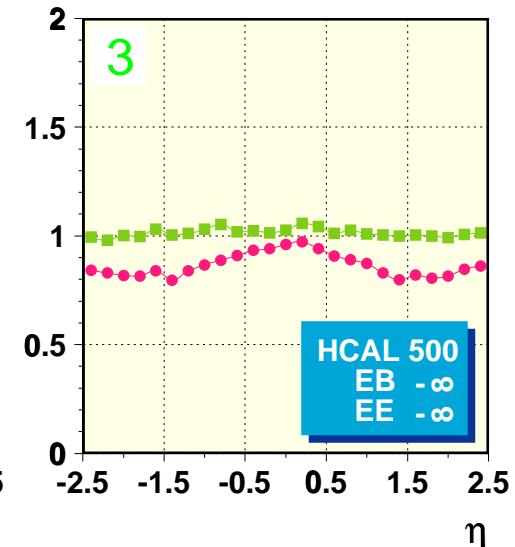
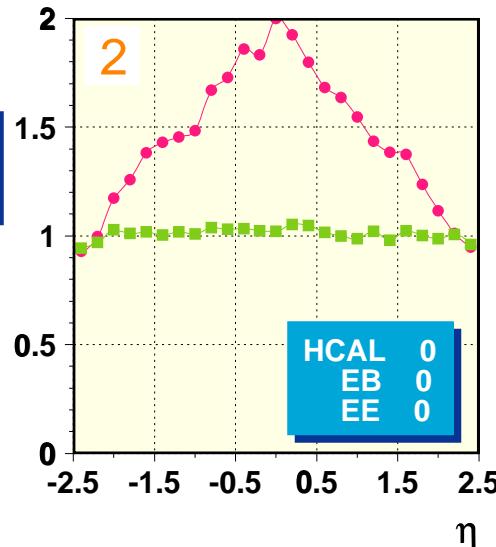
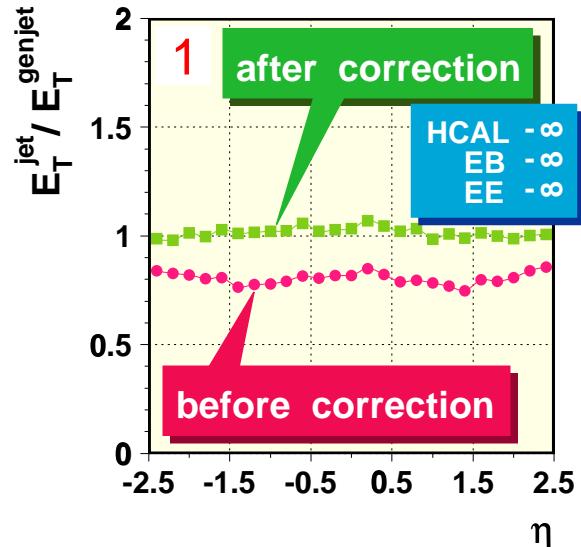


$Z'(120)$ JET CORRECTIONS (I)



$E_T^{\text{genjet}} > 20 \text{ GeV}$

$E_T^{\text{jet}} > 20 \text{ GeV}$



S. Abdullin 2/11/2001

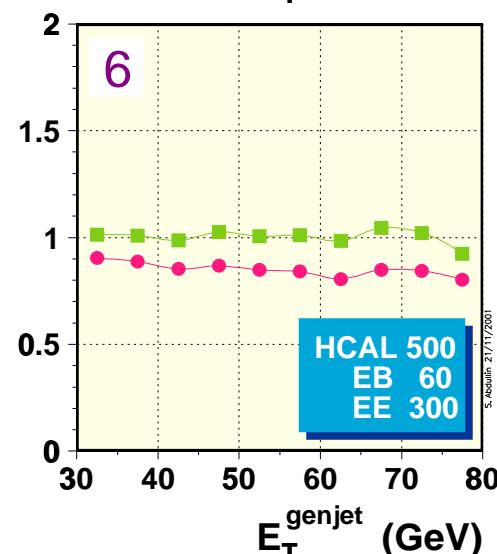
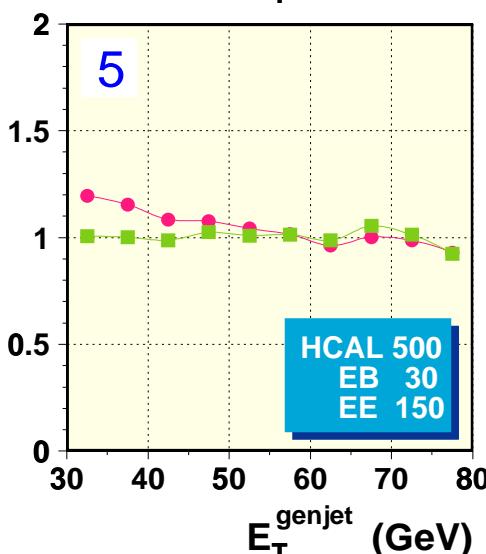
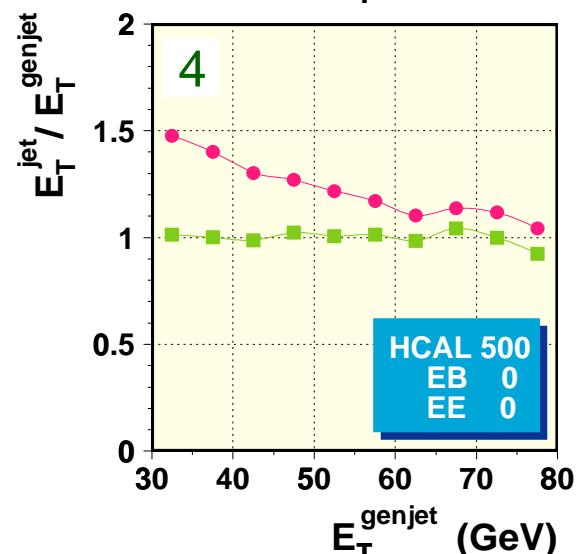
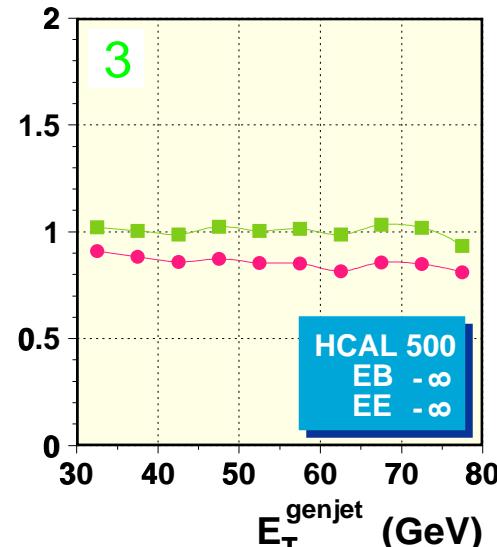
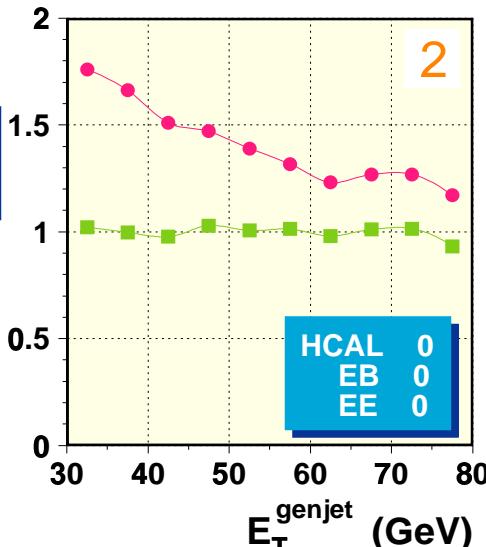
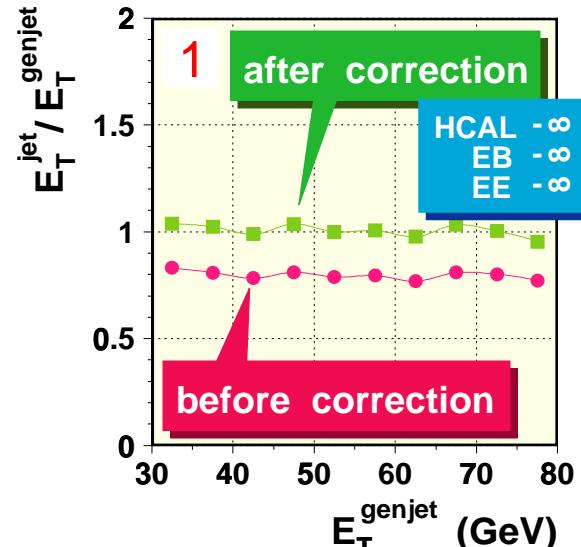


$Z'(120)$ JET CORRECTIONS (II)



$E_T^{\text{genjet}} > 20 \text{ GeV}$

$E_T^{\text{jet}} > 20 \text{ GeV}$



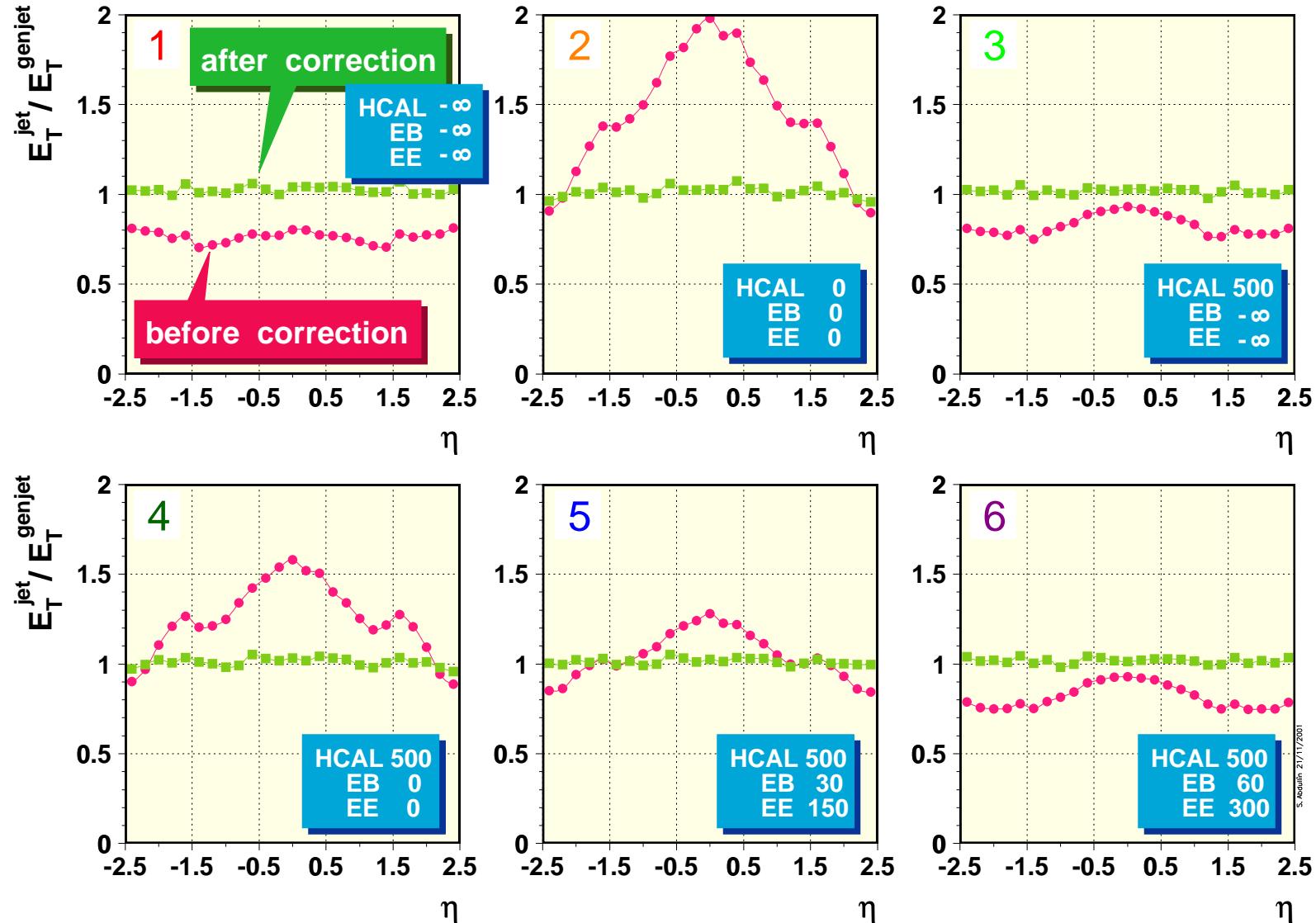


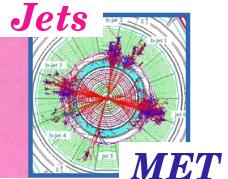
QCD JET CORRECTIONS



$E_T^{\text{genjet}} > 20 \text{ GeV}$

$E_T^{\text{jet}} > 20 \text{ GeV}$





BACK-OF-ENVELOPE ESTIMATES

"It's so simple, it might even work!"

(Dan Green ?)

■ ECAL : ~ 2500 Xtals in R=0.5, $\sigma \sim 27.2$ MeV in EB

■ HCAL : ~ 100 towers,

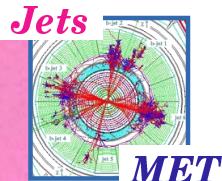
$$\sigma = 200 \text{ MeV} * \text{corr} * \sqrt{2 \text{ readouts} * 2 \text{ layers}} \sim 450 \text{ MeV}$$

+ HO !

cut (σ)	fraction $> \text{cut}$	mean (σ)	jet content (GeV)	
			ECAL	HCAL
0	0.5	0.8	27.2	18.0
1	0.15850	1.524	16.4	10.9
2	0.02875	2.372	4.6	3.0
3	0.00135	3.276	0.3	0.2

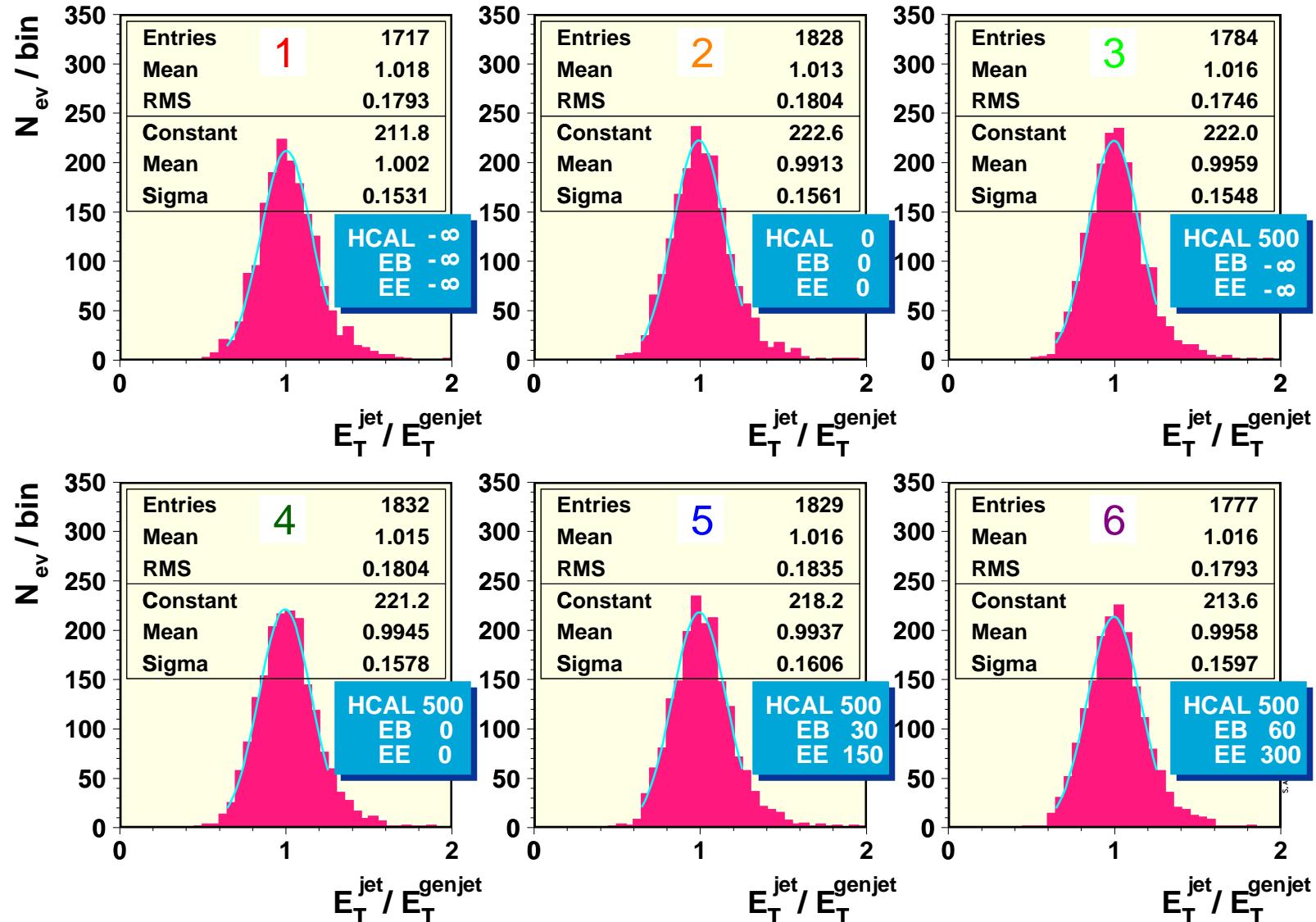


$Z'(120)$ RESULTS : JETS



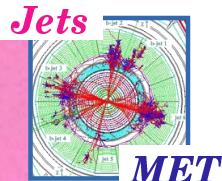
$E_T^{\text{genjet}} > 20 \text{ GeV}$

$E_T^{\text{jet}} > 20 \text{ GeV}$

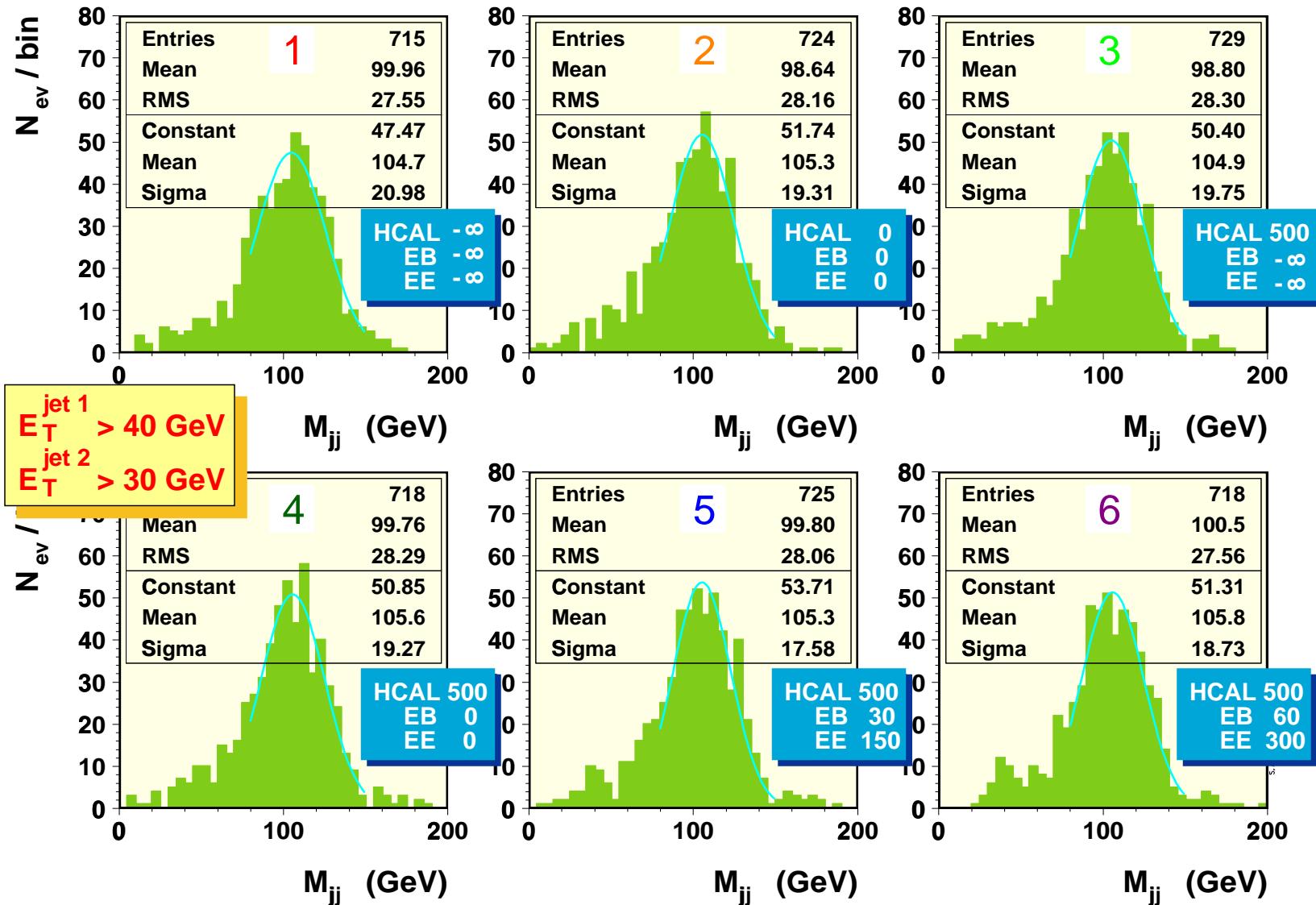


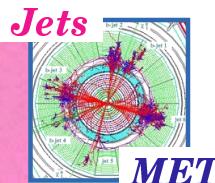


Z'(120) RESULTS : MASS

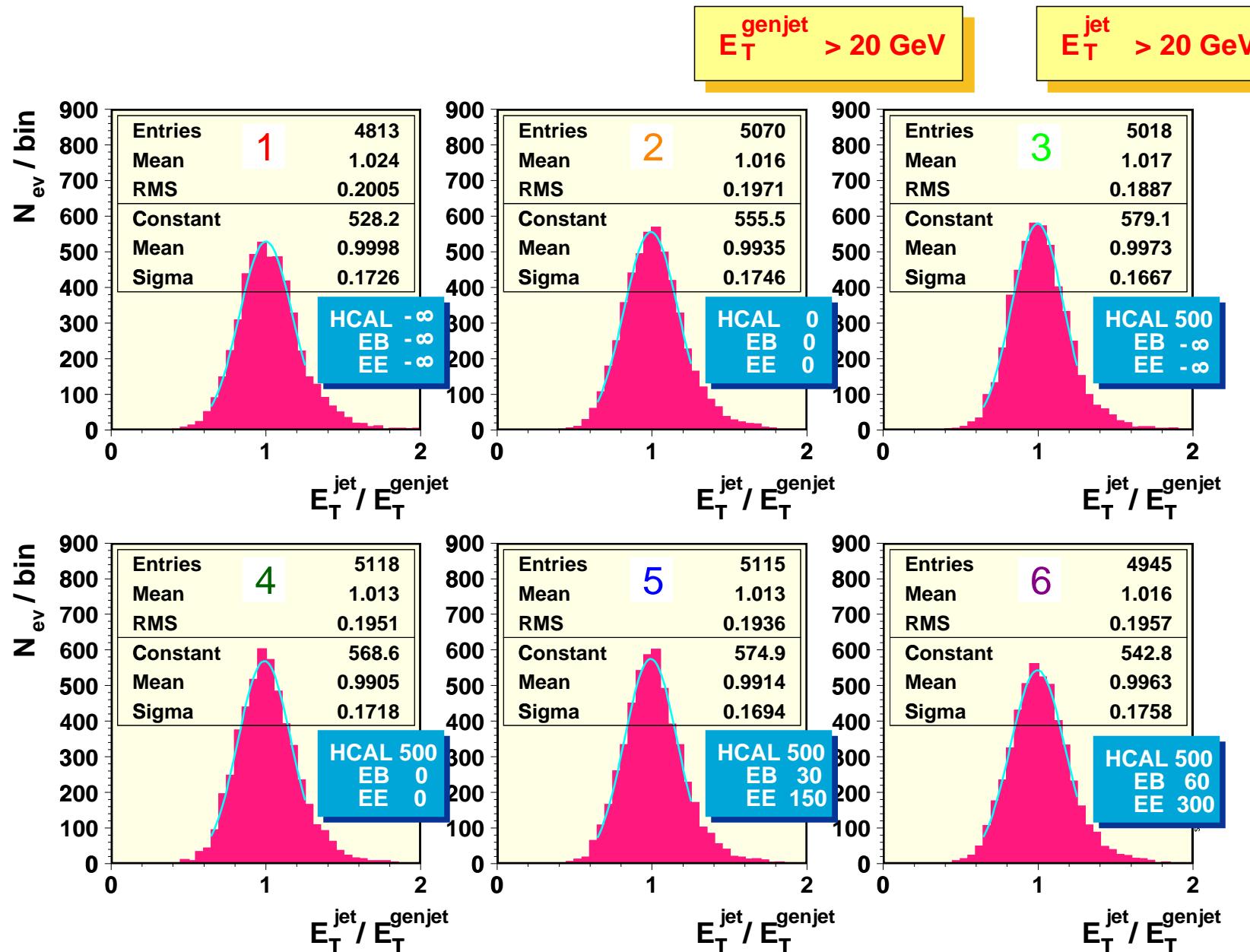


Two hardest jets





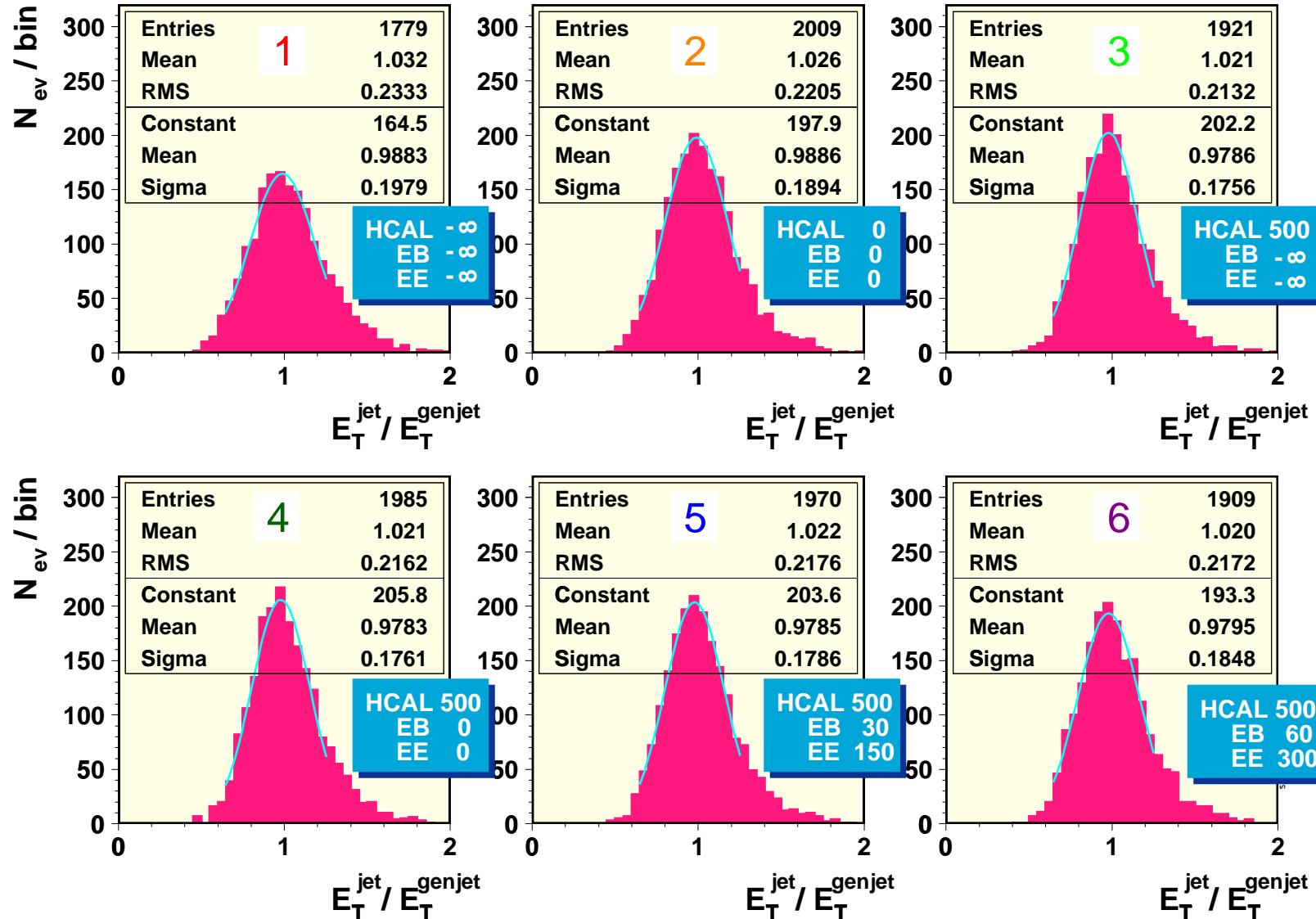
QCD RESULTS : JETS (I)





QCD RESULTS : JETS (II)

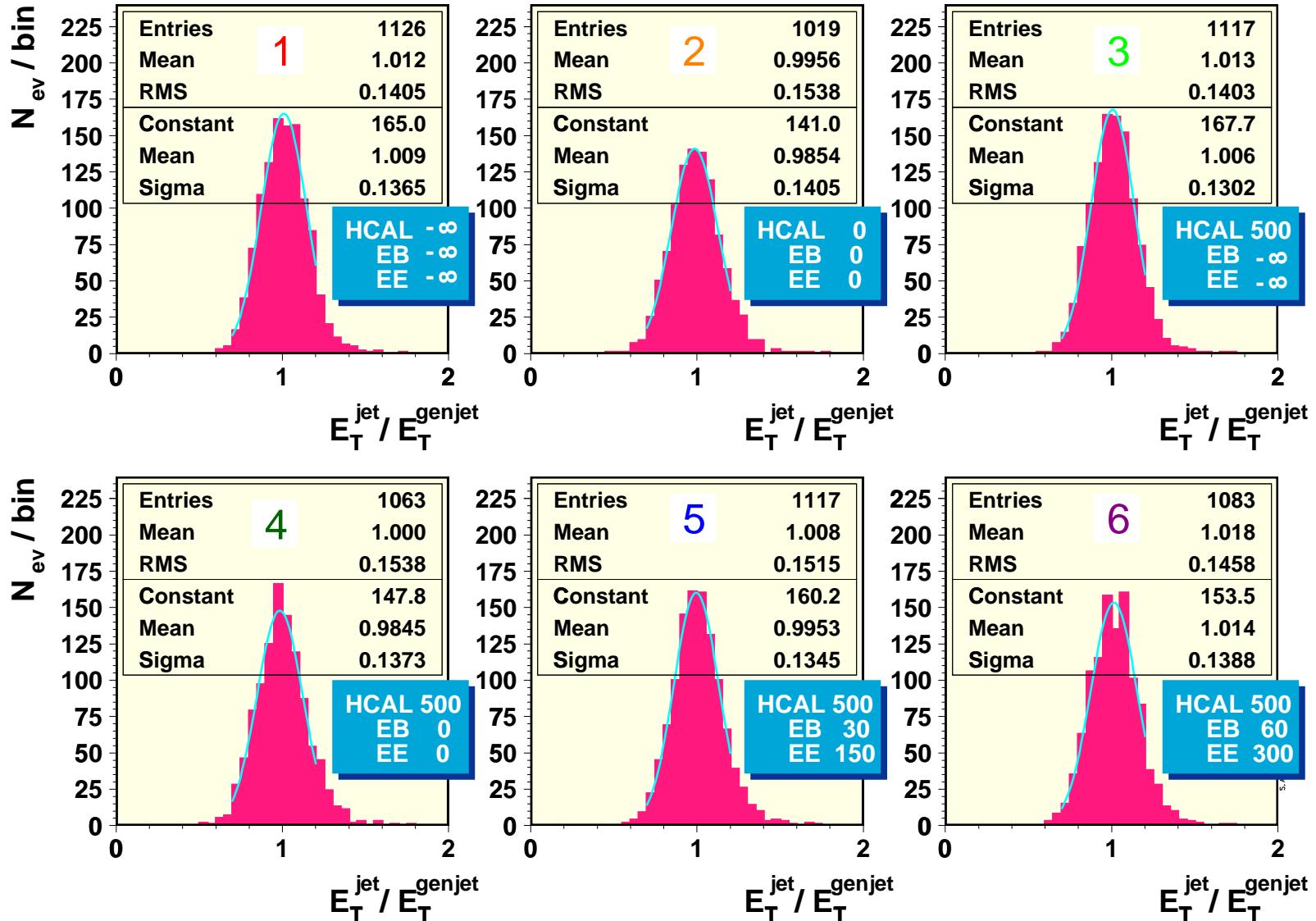
● $|\eta| < 0.8$





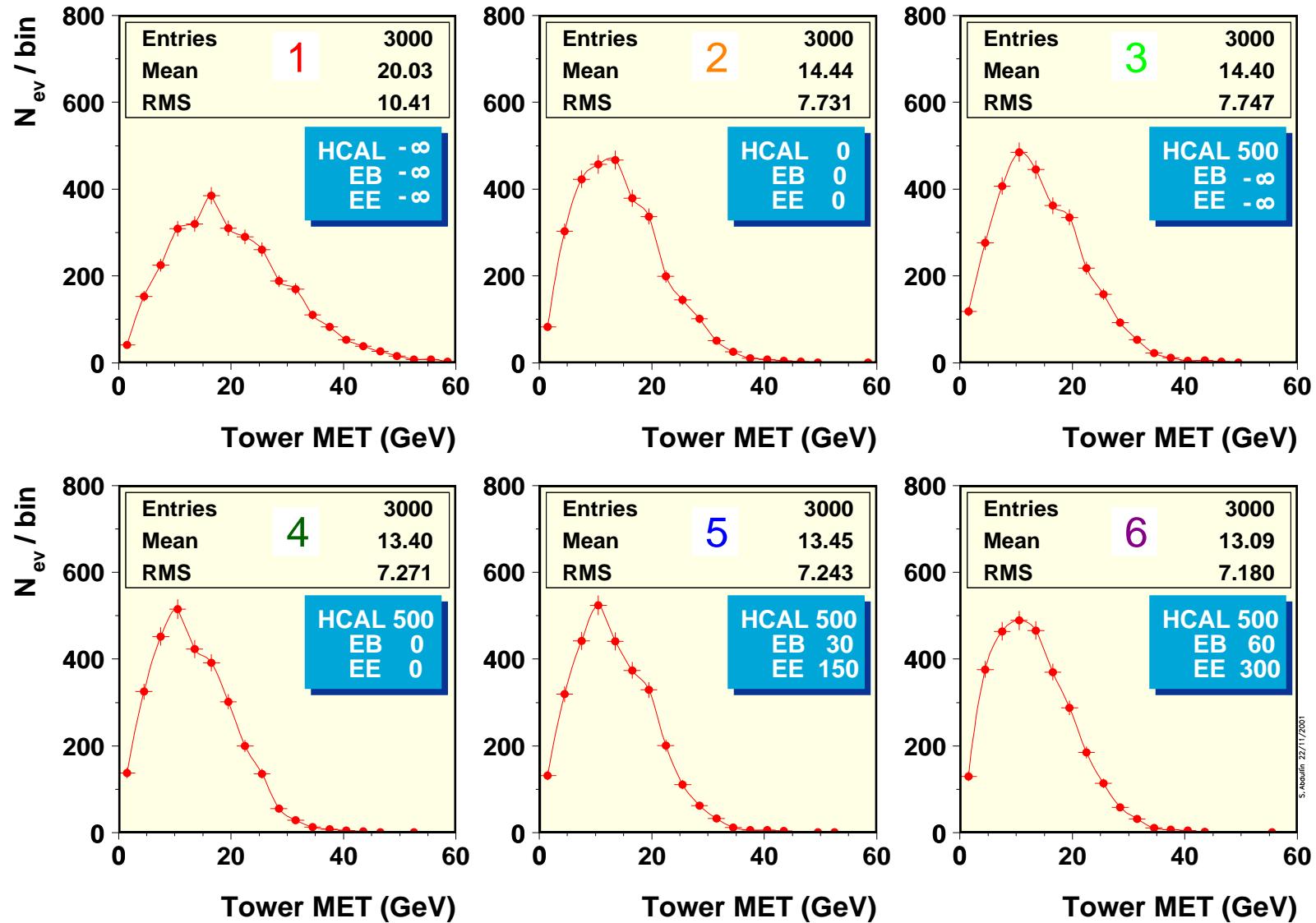
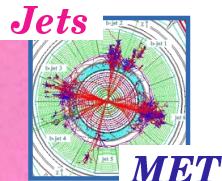
QCD RESULTS : JETS (III)

● $1.8 < |\eta| < 2.5$



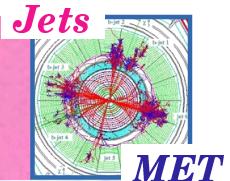


QCD RESULTS : MET





CONCLUSIONS



- 👉 **2 σ ECAL thresholds look acceptable for jets/MET physics
(at the current noise level)**
- 👉 **Probably even higher ...**
- 👉 **Jet physics affected rather by "physical" and calibrational issues
(more than by 1 σ \rightarrow 2 σ cut variation)**
- 👉 **2-3 σ cut seems to be useful to get rid of the noise ...**